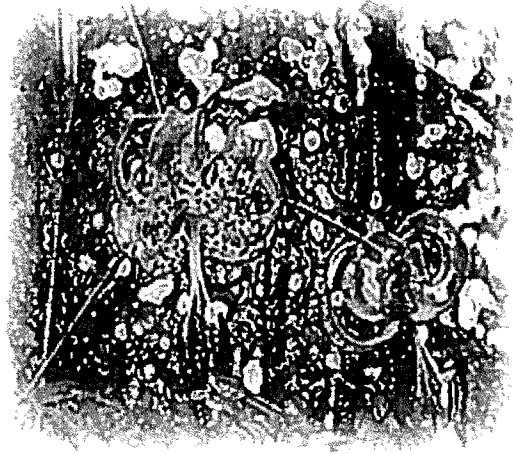


## APPENDIX E



## BIOLOGICAL SYSTEMS CONSULTANTS, INC.



**Nally and Hamilton Enterprises, Inc.**

**DNR Permit # 848-0211**

**Ponds 2 and 2A Restoration Plan**

**BSC # 2742**

---

**P.O. Box 54954  
Lexington, KY 40555  
(859)263-4142**

**Nally and Hamilton Enterprises, Inc.**  
**DNR Permit # 848-0211**  
**Ponds 2 and 2A Restoration Plan**  
**BSC # 2742**

**Prepared For ;**

**Nally and Hamilton Enterprises, Inc.**  
**P.O. Box 157**  
**Bardstown, KY. 40004**

**Prepared By ;**

**Biological Systems Consultants, Inc.**  
**P.O. Box 54954**  
**Lexington, KY. 40555**

**09/15/07**

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## **1.0 Introduction**

The following stream reconstruction template has been prepared for Nally and Hamilton Enterprises Department of Natural resources(DNR) mining permit application # 848-0211. It includes a template for stream reconstruction for the removal of ponds 2 and 2A, and associated corridors, located in the main stem of Fugitt Creek in Harlan county Kentucky. Since the sediment control structures were in place at the time of the site inspection, a 500 foot segment of stream located below the downstream structure was surveyed and assessed to determine the stream morphology for post removal construction. This included ;

- (1) Photographing the stream segment
- (2) Determining the existing stream conditions including gradient, riffle/pool ratios, morphological dimensions, substrate materials, sinuosity pattern, and stream type as determined by the Rosgen process and
- (3) qualifying the stream habitat by scoring from the KDOW high gradient assessment sheets

The following section 2.0 provides a narrative description of the pond removal and post pond removal techniques with the proposed construction table contained in appendix A.

All supportive documentation is then presented in Appendix B through D and mitigation structures and revegetation plan are included in appendix E and F.

## **2.0 Pond Removal and Stream Reconstruction**

Sediment pond stream mitigation activities are proposed to be performed when reclamation and water quality standards are determined adequate by the regulating agencies. The steps outlined below will be implemented ;

- (1) The ponds will be dewatered through pumping or trenching and any principal spillway pipes removed
- (2) Any sediments or fines in the pond will be allowed to dry and positive drainage restored
- (3) Sediment pond embankment materials will be graded over any sediments or adjacent disturbed areas to create a bankfull channel, profile and sinuosity pattern comparable to the pre-impact scenario as illustrated on the appendix A construction table.
- (4) Substrate materials will be re-distributed or added to the channel for stabilization.
- (5) Emergency spillway materials(rock and boulders) will be used to create cascades and pools
- (6) A typical cross vein structure will be placed at the pre-existing bank location and a step pool scenario(cascade) will be created below to connect the original stream channel to the mitigation area
- (7) A selection of stream structures as shown on the drawings in appendix E will be placed across the reclaimed areas to create a riffle frequency comparable to that noted in appendix A. It is anticipated, that the log vane and native material bank revetment will be the selected enhancement features for pond pool restoration and enhancement. Substrate materials used to create the stream structure will resemble that as indicated on the table in appendix A which was simulated form the level II assessment. The other enhancement features will then be placed, to create the riffle/pool scenarios. The goal of the restoration and enhancement efforts is to increase the variable input RBP habitat scores to those targeted for the immediately after and mature mitigation scenario presented in the existing COE application. These determinations will be made through the success criteria and monitoring plan as discussed in that permit.
- (8) The mitigation site will then be seeded and planted, in the patterns, and with the grass and tree species as contained in appendix F. However, no trees will be set within twice the width of the channel centerline(channel width) and a minimum riparian corridor of 18 meters will be established.

(9) The corridor between ponds 2 and 2A will not be disturbed unless determined necessary by the regulating agencies as canopy currently exists. However, stream structures will be placed, if, necessary to maintain flow and establish morphology and structure.

As discussed in the BMP plan in appendix G, temporary sediment control in the form of silt fencing and/or straw bales will be placed downstream of the structures during mitigation activities, if necessary, or temporary diversions may be used to direct surface runoff which might impede construction efforts. However, if performed during low flow conditions, temporary diversions are not anticipated to be needed.

### **3.0 Conclusions**

The proposed mitigation plan for ponds 2 and 2A will be restored to the original stream structure as shown on the template table in appendix A. These dimensions will be applied to reconstructed and reclaimed areas. Disturbances in corridors will be kept to a minimum to maintain the existing canopy and continue the distribution of detritus, habitat and stream function.



**Appendix A**  
**Proposed Construction Table**

<b>RESTORED STREAM CHANNEL SCHEDULE</b>
---

RECONSTRUCTED STREAM CHANNEL	GENERAL INFORMATION									
	STREAM TYPE	LENGTH (FT)	AVG. SLOPE (%)	W (FT)	WV (FT)	D16 (mm)	D35 (mm)	D50 (mm)	D84 (mm)	D95 (mm)
Ponds 2 and 2A	A2+	All	9-13%	29-35	31-37	224	310	498	818	1512

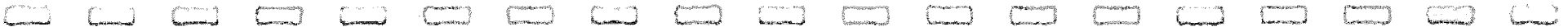
RIFFLE POOL RATIO	RIFFLE				POOL				STREAM GEOMETRY			
	LR (FT)	DR1 (FT)	DR2 (FT)	DR3 (FT)	LP (FT)	DP1 (FT)	DP2 (FT)	DP3 (FT)	ML (FT)	RC (FT)	SR %	S
4:01	28-50	0.8-1.5	0.8-1.2	0.8-1.1	7 to 15	1-1.25	0.8-1.5	0.8-1.5	N/A	N/A	30	1.12

NOTES: W=BANKFILL WIDTH WV=MINIMUM VALLEY FLOOR WIDTH D50=MEDIAN STONE SIZE

ML=MEANDER LENGTH RC=RADIUS OF CURVATURE BW=BELT WIDTH S=SINUOSITY

LR=RIFFLE WIDTH DR1 thru DR3=RIFFLE DEPTHS SR=RIFFLE SLOPE LP=POOL LENGTH DP1 thru DP3=POOL DEPTHS

**Appendix B  
Photographs**





Nally & Hamilton Enterprises, Inc.  
DNR # 848-0211  
Fugitt Creek Stream Restoration Plan Images





**Appendix C**  
**Rosgen Determination**

## Stream Survey Data Sheet

Site: 0+00 - 1+24

Area at Bankfull, A (bkf), ft <sup>2</sup>	15__
Width at Bankfull, W(bkf), ft.	29__
Width Flood Prone Area, W (fpa), ft.	31__
Mean Depth at Bankfull, D(bkf)= A(bkf)/W(bkf), ft.	0.5__
Entrenchment Ratio, ER=W(fpa)/W(bkf), ft./ft.	1.06__
Width to Depth Ratio, W/D=W(bkf)/D(bkf), ft./ft.	58__
Length of Channel Thalweg, L(tw), ft.	507__
Length of Valley, L(valley), ft.	450__
Sinuosity, K=L(tw)/L(valley), ft./ft.	1.12__
Average Slope of Channel, %	9__
D16 Particle Size (mm)	192__
D35 Particle Size (mm)	256__
D50 Particle Size (mm)	384__
D84 Particle Size (mm)	612__
D95 Particle Size (mm)	1024__
<b>Rosgen Stream Type</b>	<b>A2__</b>

## Stream Survey Data Sheet

Site: 1+24 - 5+07

Area at Bankfull, A (bkf), ft <sup>2</sup>	35__
Width at Bankfull, W(bkf), ft.	35__
Width Flood Prone Area, W (fpa), ft.	37__
Mean Depth at Bankfull, D(bkf)= A(bkf)/W(bkf), ft.	1.0__
Entrenchment Ratio, ER=W(fpa)/W(bkf), ft./ft.	1.05__
Width to Depth Ratio, W/D=W(bkf)/D(bkf), ft./ft.	35__
Length of Channel Thalweg, L(tw), ft.	507__
Length of Valley, L(valley), ft.	450__
Sinuosity, K=L(tw)/L(valley), ft./ft.	1.12__
Average Slope of Channel, %	13__
D16 Particle Size (mm)	256__
D35 Particle Size (mm)	364__
D50 Particle Size (mm)	612__
D84 Particle Size (mm)	1024__
D95 Particle Size (mm)	2000__
<b>Rosgen Stream Type</b>	<b>A2+__</b>



		Station ID:		2742
Habitat Parameter		Fugitt Creek Restoration Segment		
1. Epifaunal Substrate			13	
2. Embeddedness			12	
3. Velocity/Depth Regime			13	
4. Sediment Deposition			13	
5. Channel Flow Status			13	
6. Channel Alteration			16	
7. Frequency of Riffles			16	
8. Bank Stability				
	Left		8	
	Right		8	
9. Vegetative Protective				
	Left		9	
	Right		9	
10. Riparian Width				
	Left		9	
	Right		9	
11. Total			148	
11. S.C.			220	
12. PH				
13. Distance				
Pond(T)				
Mining(T)				
Fill(P)				
Impacts				
Photos				
Vegetation			Birch	
			Poplar	
Canopy %			Rhododendron	

**Appendix D**  
**Reference Segment Drawings**

LE AD

## NALLY &amp; HAMILTON ENTERPRISES

DNR Permit # 848-0211

## Fugitt Creek Reference Segment Profile

~~~~~ = Riffle/Boulder

— = Bedrock

○ = Pool

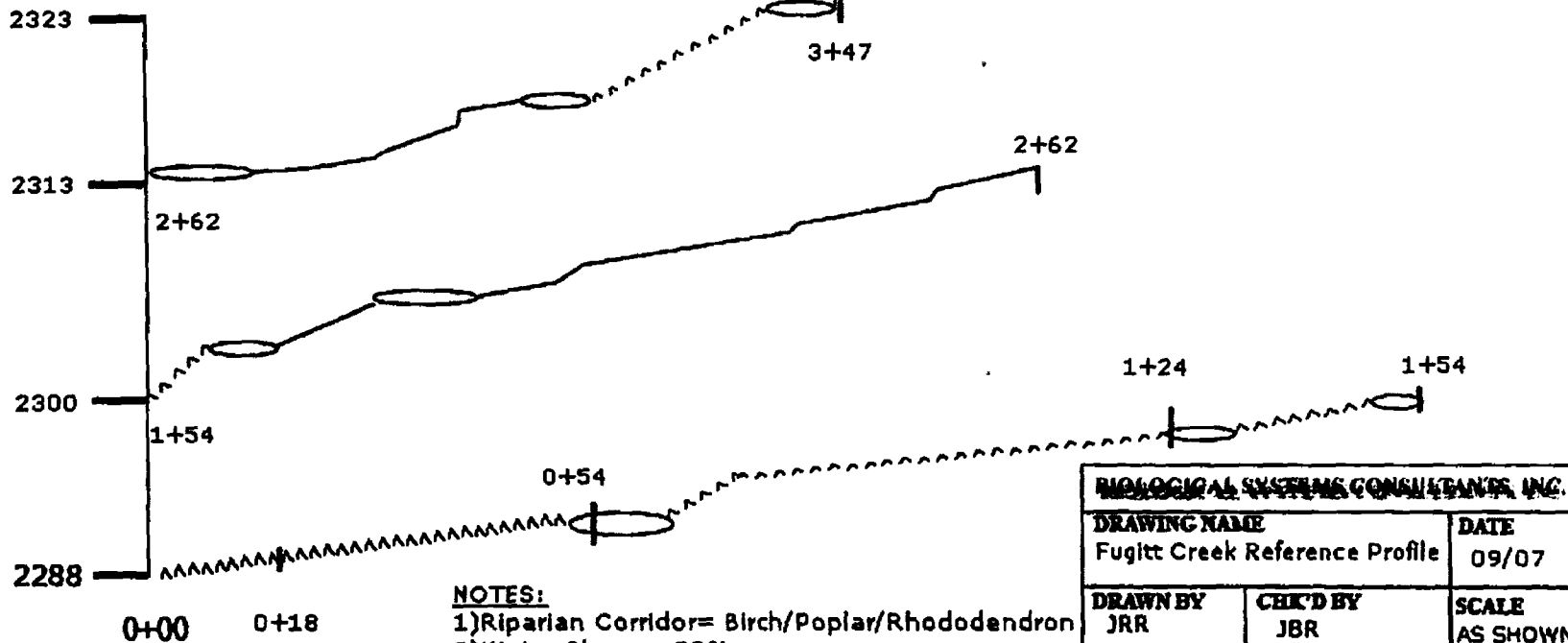
0' 10'

SCALE (Vertical)

0' 20'

SCALE (Horizontal)

ELEVATION

NOTES:

- 1) Riparian Corridor = Birch/Poplar/Rhododendron
- 2) Water Slope = 30%
- 3) Slope Gradient - 9-13
- 4) Overall Riffle/Pool Ratio 4:1

| BIOLOGICAL SYSTEMS CONSULTANTS, INC.           |                 |                           |
|------------------------------------------------|-----------------|---------------------------|
| DRAWING NAME<br>Fugitt Creek Reference Profile |                 | DATE<br>09/07             |
| DRAWN BY<br>JRR                                | CHK'D BY<br>JBR | SCALE<br>AS SHOWN         |
| CLIENT<br>NALLY & HAMILTON ENT.                |                 | PROJECT<br>NUMBER<br>2742 |

LEAND

k=sinuosity

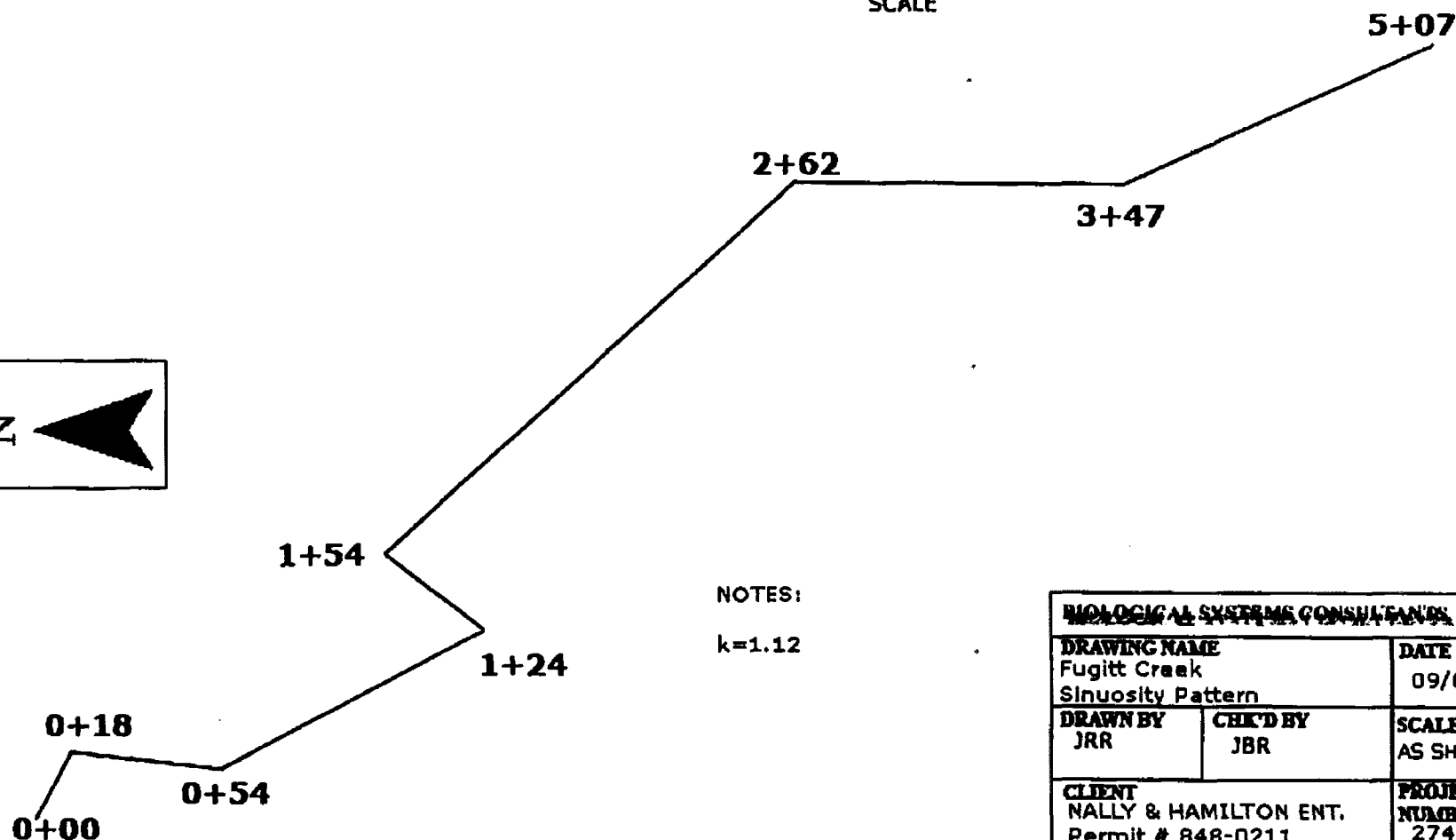
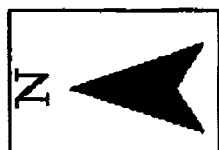
# NALLY & HAMILTON ENTERPRISES

## DNR Permit # 848-0211

### Fugitt Creek Reference Segment

### Sinuosity Pattern

0' 40'  
SCALE



NOTES:

k=1.12

| BIOLOGICAL SYSTEMS CONSULTANTS, INC.                 |                   |                           |
|------------------------------------------------------|-------------------|---------------------------|
| DRAWING NAME<br>Fugitt Creek<br>Sinuosity Pattern    |                   | DATE<br>09/07             |
| DRAWN BY<br>JRR                                      | CHECKED BY<br>JBR | SCALE<br>AS SHOWN         |
| CLIENT<br>NALLY & HAMILTON ENT.<br>Permit # 848-0211 |                   | PROJECT<br>NUMBER<br>2742 |

Stream Survey Data Sheet  
Stream Name: Fugitt Creek Restoration\_Pattern\_\_

Date: 09/12/07-09/13-07\_

|               |        |    |     |      |      |      |
|---------------|--------|----|-----|------|------|------|
| (El. 2288)    |        | %  | (L) | (AW) | (MD) | (AD) |
| Station_0+00_ | Pool   | 10 | 15  | 10   | 0.3  | 0.3  |
| To            | Riffle | 90 | 50  | 2    | 0.3  | 0.3  |
| Station1+24_  | Run    |    |     |      |      |      |
| (El.2298 )    |        |    |     |      |      |      |

|                 |        |    |     |      |      |      |
|-----------------|--------|----|-----|------|------|------|
| (El.2298 )      |        | %  | (L) | (AW) | (MD) | (AD) |
| Station_1+24    | Pool   | 20 | 7   | 7    | 0.5  | 0.5  |
| To Station_5+07 | Riffle | 80 | 28  | 2    | 0.25 | 0.25 |
| (El. 2345 )     | Run    |    |     |      |      |      |

|                  |        |   |     |      |      |      |
|------------------|--------|---|-----|------|------|------|
| (El. _____)      |        | % | (L) | (AW) | (MD) | (AD) |
| Station _____    | Pool   |   |     |      |      |      |
| To Station _____ | Riffle |   |     |      |      |      |
| (El. _____)      | Run    |   |     |      |      |      |

|                  |        |   |     |      |      |      |
|------------------|--------|---|-----|------|------|------|
| (El. _____)      |        | % | (L) | (AW) | (MD) | (AD) |
| Station _____    | Pool   |   |     |      |      |      |
| To Station _____ | Riffle |   |     |      |      |      |
| (El. _____)      | Run    |   |     |      |      |      |

L= Length

AW= Average Width

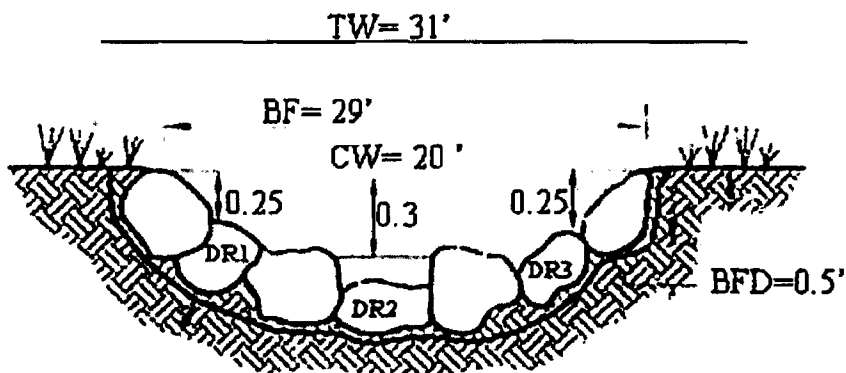
MD= Maximum Depth

AD= Average Depth

## FUGITT CREEK REFERENCE CROSS-SECTION

STATION:

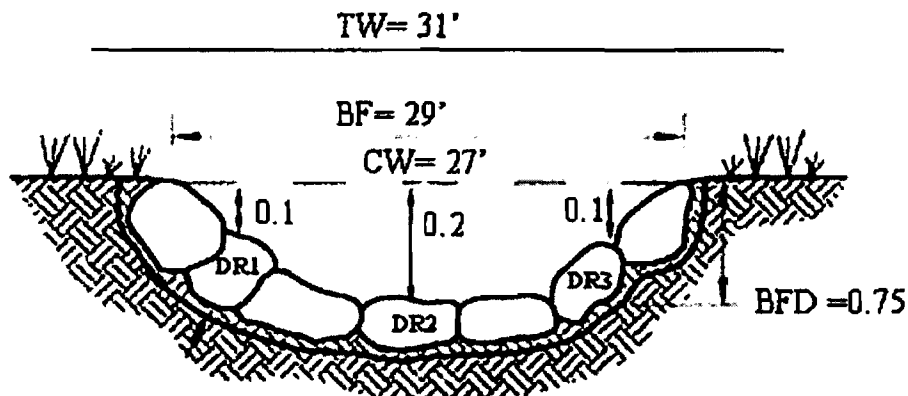
0+00 - 1+24



## POOL, SECTION

N.T.S

## NOTE:

ALL MEASUREMENTS  
IN FEET

## RIFFLE SECTION

N.T.S

## LEGEND

BF = Bankfull Width

CW = Water Width

DR = Water Depth

BFD = Bankfull Depth

TW = Total Width

## BIOLOGICAL SYSTEMS CONSULTANTS, INC.

## DRAWING NAME

Fugitt Creek Reference Segment I  
Cross - Section

## DATE

08/07

## DRAWN BY

JRR

## CHK'D BY

JBR

## SCALE

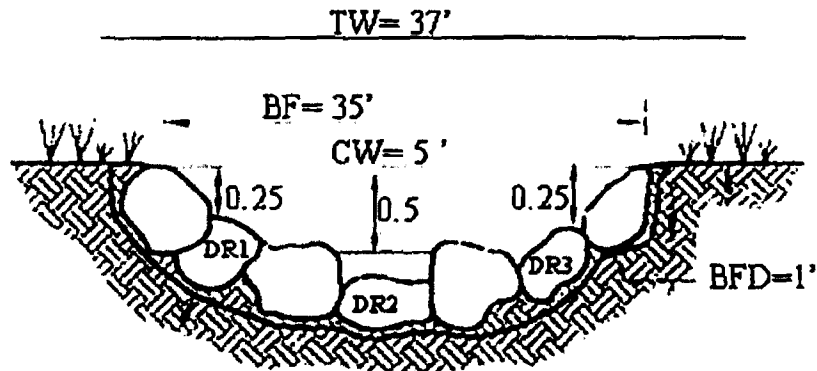
N.T.S

## CLIENT

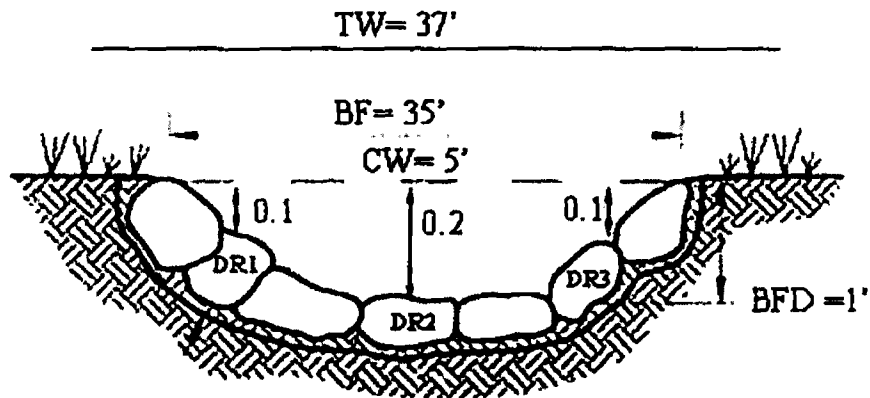
NALLY & HAMILTON ENT.  
PERMIT # 848-0211PROJECT  
NUMBER

2742

## FUGITT CREEK REFERENCE CROSS-SECTION

STATION:  
1+24 - 5+07POOL SECTION

N.T.S.

NOTE:  
ALL MEASUREMENTS  
IN FEET'RIFFLE SECTION

N.T.S.

LEGEND

BF = Bankfull Width  
 CW = Water Width  
 DR = Water Depth  
 BFD = Bankfull Depth  
 TW = Total Width

## BIOLOGICAL SYSTEMS CONSULTANTS, INC.

DRAWING NAMEFugitt Creek Reference Segment  
Cross - Section 2DATE

08/07

DRAWN BY

JRR

CHEK'D BY

JRR

SCALE

N.T.S.

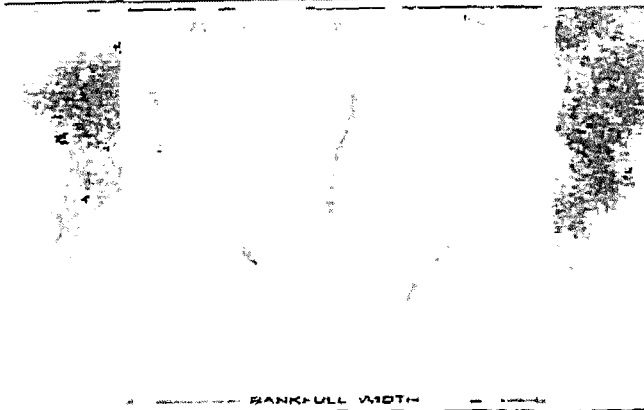
CLIENTNALLY & HAMILTON ENT.  
PERMIT # 848-0211PROJECT  
NUMBER

2742

**Appendix E**  
**Standard Mitigation Structure Design**



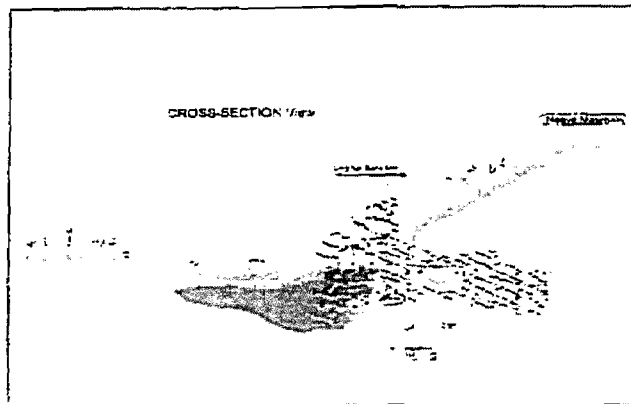
807-0353  
Typical Structure Design



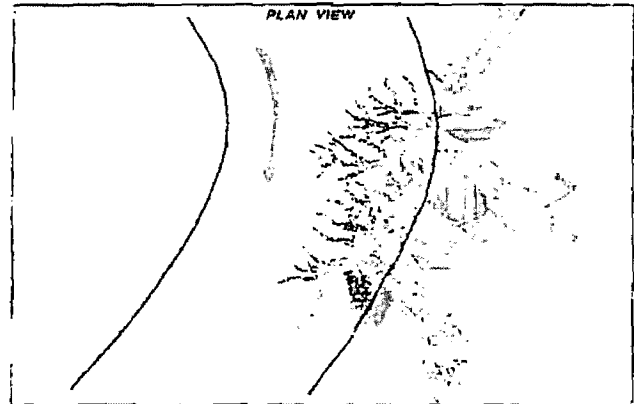
Cross-Vane Structure



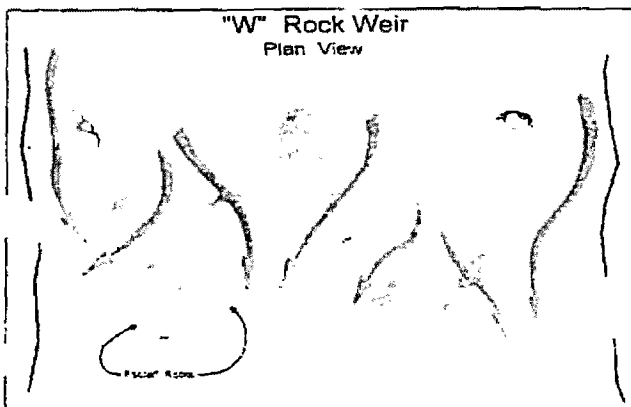
J-Hook Vane.



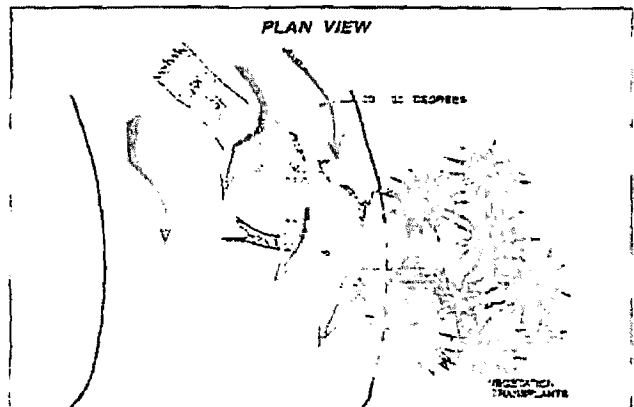
Native material bank revetment. (Rosgen, 1993a)



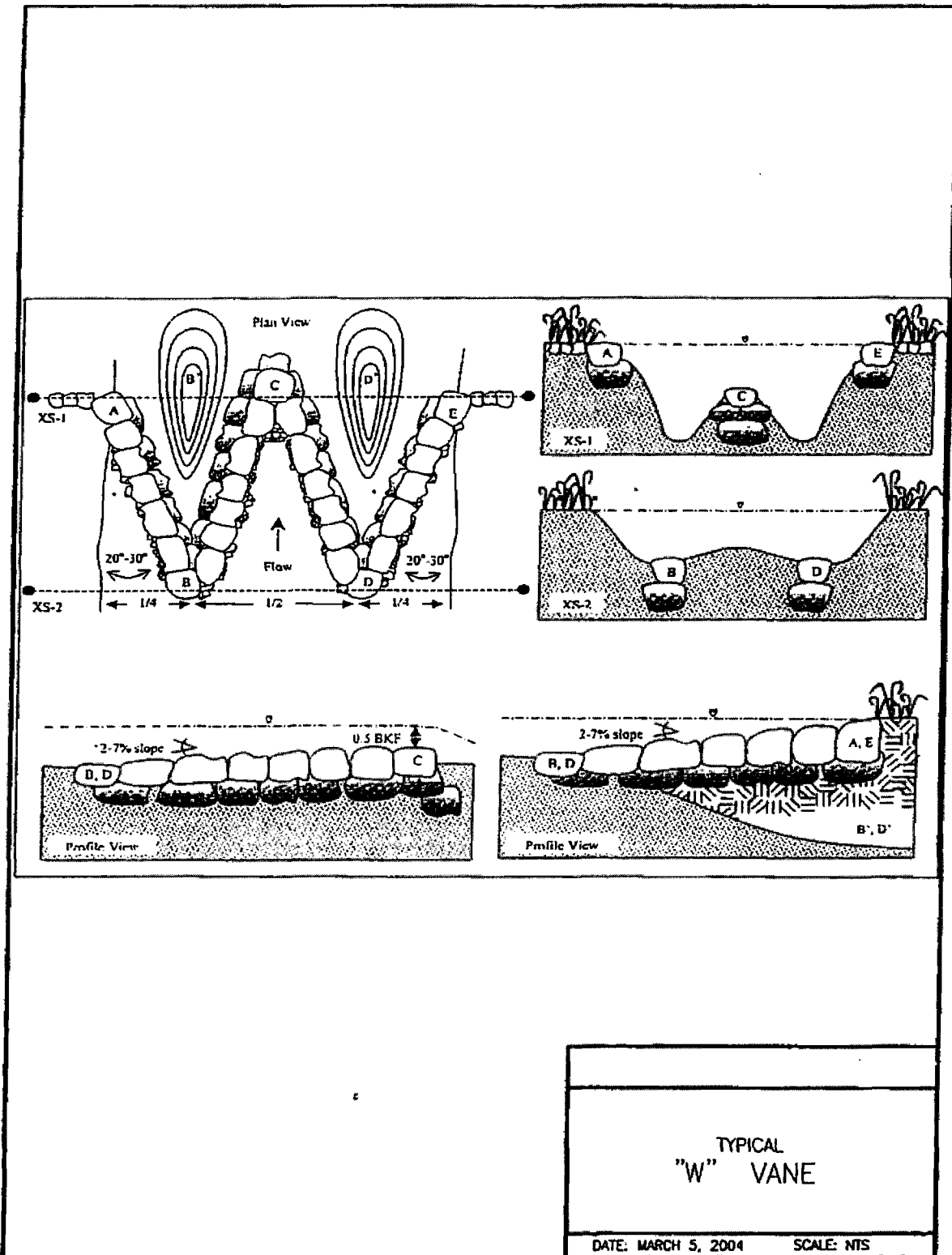
Native material bank revetment. (Rosgen, 1993a)

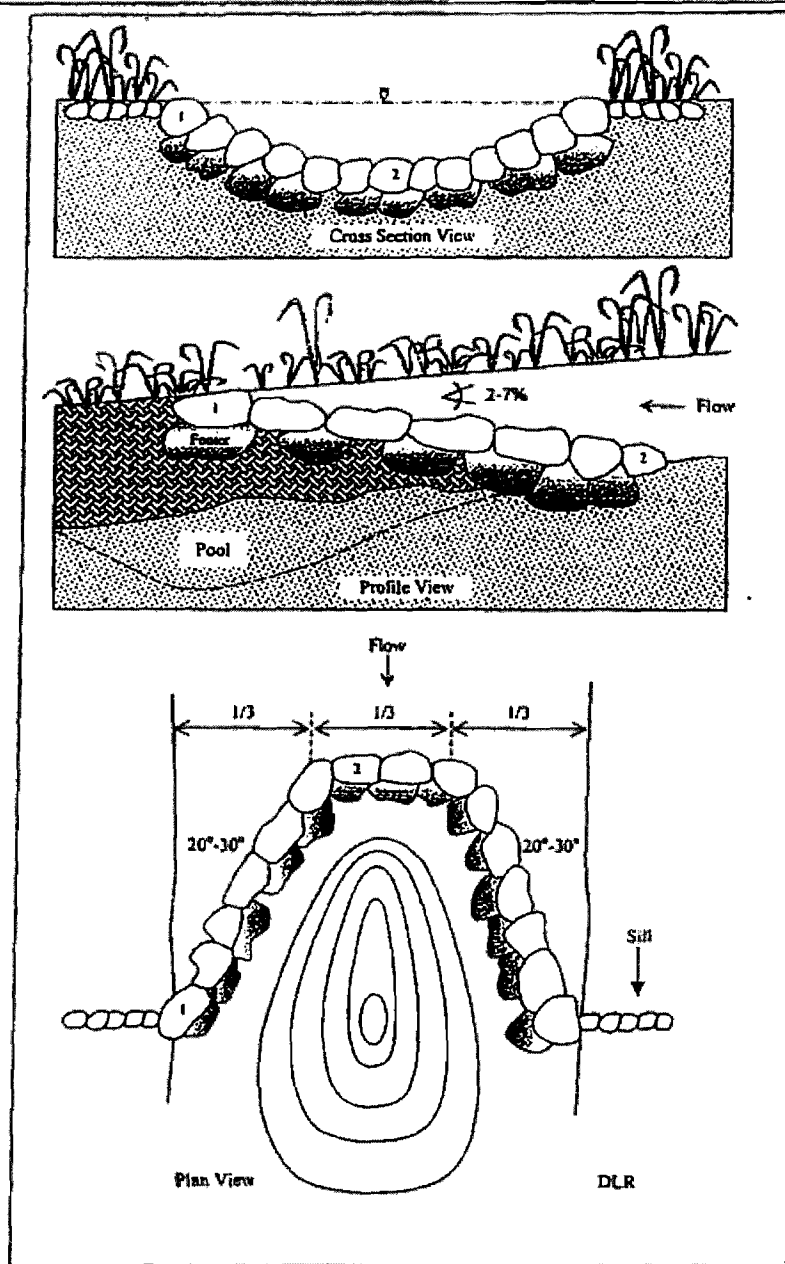


"W" rock weir. (Rosgen, 1993a)



Log-vane bank feature. (Rosgen, 1993a)

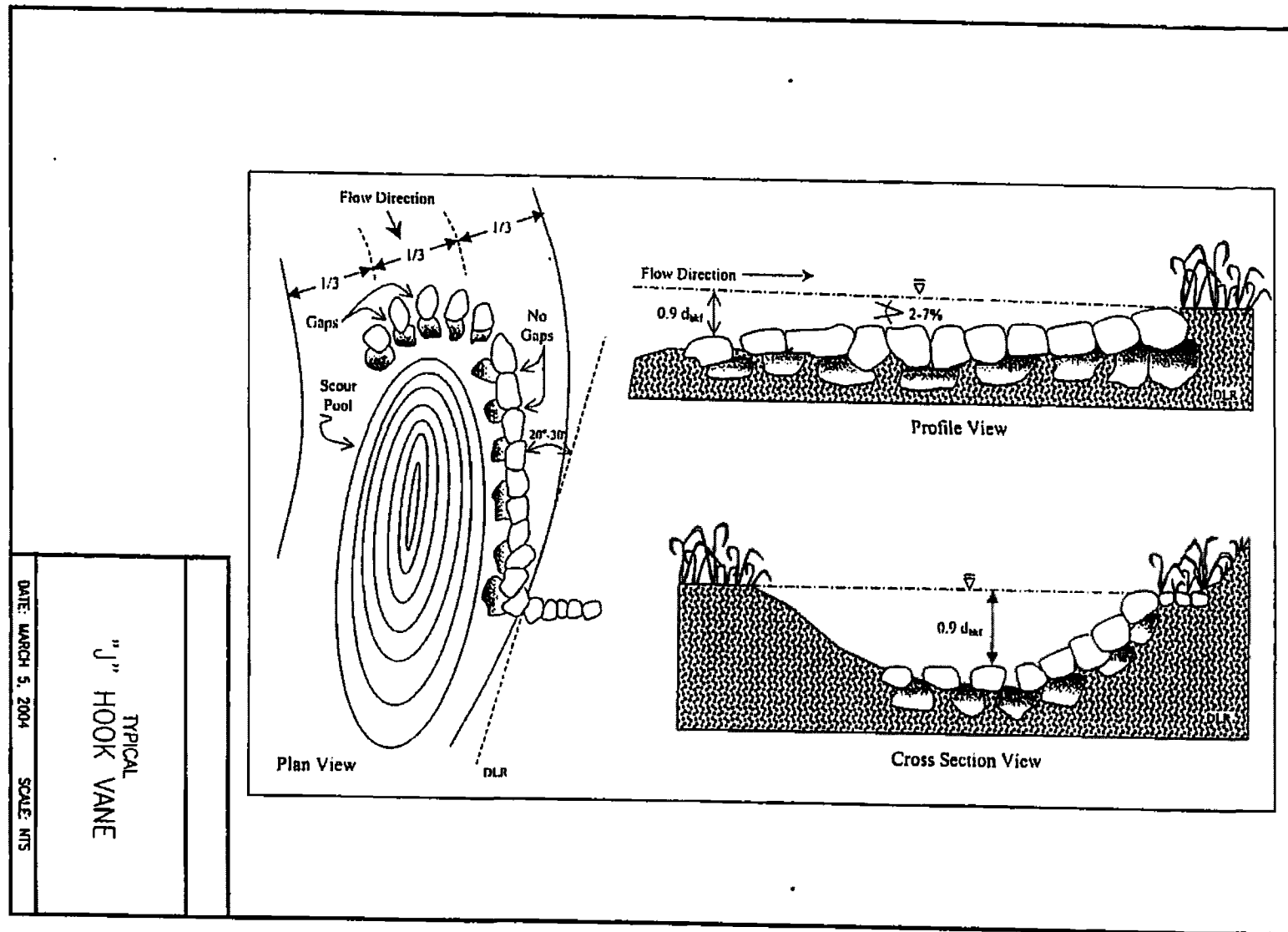




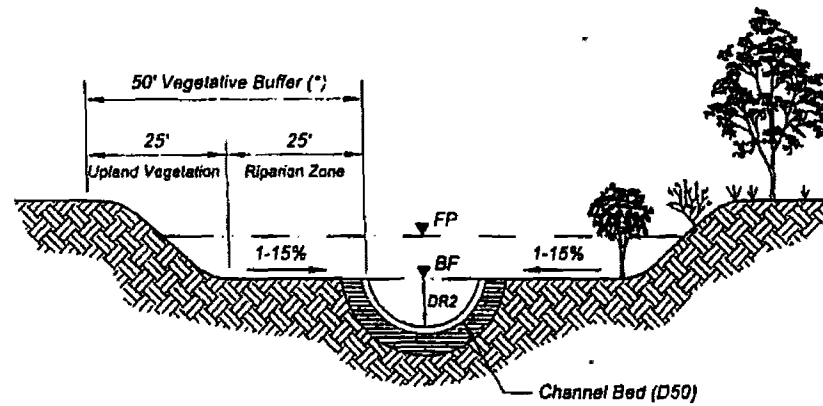
TYPICAL  
CROSS VANE

DATE: MARCH 5, 2004

SCALE: NTS



**Appendix F**  
**Revegetation Scenario**



TYPICAL SECTION  
RECONSTRUCTED STREAM CHANNEL VEGETATION  
N.T.S.

BIOLOGICAL SYSTEMS  
CONSULTANTS, INC.

RESTORED STREAM CHANNEL DETAIL

PROJECT NO. DATE: 03/06

List of plantings

Revegetation Plan

807-0353

TABLE I

## POSTMINING REVEGETATION PLAN

| GROUND COVER                |                   | TREE AND SHRUB SPECIES                                                                                                                                                                                                                      |                   |
|-----------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Spring (Feb. 15 - May 15)   |                   | (October 15 - May 15)                                                                                                                                                                                                                       |                   |
| <u>Species</u>              | <u>Rate/Acre</u>  | HARD MAST PRODUCERS(ONE SPECIES)                                                                                                                                                                                                            |                   |
| Orchardgrass                | 10 lbs            | white oak                                                                                                                                                                                                                                   | 90 seedlings/acre |
| Red Clover                  | 6 lbs             | CONIFERS (ONE SPECIES)                                                                                                                                                                                                                      |                   |
| Ladino Clover               | 2 lbs             | Virginia Pine                                                                                                                                                                                                                               | 70 seedlings/acre |
| Annual Ryegrass             | 5 lbs             | SHRUBS AND SOFT MAST PRODUCERS                                                                                                                                                                                                              |                   |
| Summer (May 15 - Aug. 1)    |                   | (TWO SPECIES)                                                                                                                                                                                                                               |                   |
| <u>Species</u>              | <u>Rate/Acre</u>  | Redbud                                                                                                                                                                                                                                      | 70 seedlings/acre |
| Orchardgrass                | 10 lbs            | Green Ash                                                                                                                                                                                                                                   | 70 seedlings/acre |
| <del>Korean Lespedeza</del> | <del>15 lbs</del> | MULCH                                                                                                                                                                                                                                       |                   |
| Birdsfoot Trefoil           | 6 lbs             | <u>Type</u>                                                                                                                                                                                                                                 | <u>Rate/Acre</u>  |
| Alfalfa                     | 12 lbs            | Straw or Hay                                                                                                                                                                                                                                | 1 ½ tons          |
| Foxtail Millet              | 12 lbs            | or                                                                                                                                                                                                                                          |                   |
| Fall (Aug. 1 - Oct. 1)      |                   | Hydro-Mulch                                                                                                                                                                                                                                 | 1500 lbs          |
| <u>Species</u>              | <u>Rate/Acre</u>  | NOTE: Double the mulch rate on steep slopes. If seeding is needed during the winter, a temporary grass species will be planted and mulched. The permanent herbaceous seed mixture will be planted as soon as weather permits in the spring. |                   |
| Timothy                     | 8 lbs             |                                                                                                                                                                                                                                             |                   |
| Ladino Clover               | 2 lbs             |                                                                                                                                                                                                                                             |                   |
| Red Clover                  | 4 lbs             |                                                                                                                                                                                                                                             |                   |
| Perennial Ryegrass          | 10 lbs            |                                                                                                                                                                                                                                             |                   |
| Wet or Poorly Drained Areas |                   |                                                                                                                                                                                                                                             |                   |
| <u>Species</u>              | <u>Rate/Acre</u>  |                                                                                                                                                                                                                                             |                   |
| Redtop                      | 3 lbs             |                                                                                                                                                                                                                                             |                   |
| Reed Canarygrass            | 15 lbs            |                                                                                                                                                                                                                                             |                   |
| Alsike Clover               | 6 lbs             |                                                                                                                                                                                                                                             |                   |
| Common Lespedeza            | 10 lbs            |                                                                                                                                                                                                                                             |                   |

TABLE 2  
EQUIVALENT REVEGETATION SPECIES

| Commonly Proposed Species *                              | Acceptable Alternative Species        | Seeding Rate (lbs/acre)** |
|----------------------------------------------------------|---------------------------------------|---------------------------|
| <b>Perennial Grasses</b>                                 |                                       |                           |
| Orchardgrass                                             | Timothy                               | 8                         |
|                                                          | Switchgrass                           | 10                        |
|                                                          | Indiangrass                           | 10                        |
|                                                          | Big or Little Bluestem                | 5                         |
|                                                          | Deertongue                            | 12                        |
|                                                          | Redtop                                | 3                         |
|                                                          | Red Fescue                            | 10                        |
| *Fescue is only proposed for use on erosion prone areas. | Tall Fescue (endophyte-free)*         | 15                        |
|                                                          |                                       |                           |
| <b>Herbaceous Legumes</b>                                |                                       |                           |
| Red Clover and Ladino Clover                             | White or Alsike Clover                | 8                         |
|                                                          | <del>Korean or Kobe Lespedeza</del>   | <del>10</del>             |
|                                                          | Birdsfoot Trefoil                     | 10                        |
|                                                          | Alfalfa                               | 12                        |
|                                                          | Appalow Lespedeza                     | 20                        |
|                                                          | Sweet Clover                          | 12                        |
| <b>Temporary Species</b>                                 |                                       |                           |
| Annual Ryegrass                                          | Wheat                                 | 30                        |
|                                                          | Foxtail or <del>Japanese Millet</del> | 12                        |
|                                                          | Oats                                  | 30                        |
|                                                          | Sorghum                               | 20                        |
|                                                          | Soybeans                              | 40                        |
|                                                          | Cowpeas                               | 40                        |
|                                                          | Balbo or Winter Rye                   | 30                        |
|                                                          | Perennial Ryegrass                    | 10                        |

\* See Table 1 for commonly proposed species.

\*\* Seeding rates are for Pure Live Seed (PLS). Seed rate of the permanent species can be increased if desired, but do not exceed the seeding rate of the temporary species. Use only the temporary species at the rates shown. If more than one temporary species is used, reduce the seeding rate of each species according to the number used; i.e., for two species use one-half seeding rate of each.



TABLE 3

## ALTERNATE TREE AND SHRUB SPECIES

EQUIVALENT HARD MAST PRODUCER SPECIES

|                  |                                    |              |
|------------------|------------------------------------|--------------|
| Hickory Species* | Native Pecan                       | Black Walnut |
| Oak Species*     | *(Listed in Appendix A of TRM #21) |              |

EQUIVALENT CONIFER SPECIES

|                    |            |                |
|--------------------|------------|----------------|
| Eastern Red Cedar  | Pitch Pine | Shortleaf Pine |
| Eastern White Pine |            |                |

EQUIVALENT SHRUBS AND SOFT MAST PRODUCERS

|                   |                         |                   |
|-------------------|-------------------------|-------------------|
| Maple Species*    | Serviceberry            | Dogwood Species*  |
| Hawthorn Species  | <del>Autumn Olive</del> | White Ash         |
| Green Ash         | Bicolor Lespedeza       | Wild Plum         |
| Wild Black Cherry | Common Chokecherry      | Crabapple Species |
| Sumac Species*    | American Elder          | Sassafras         |
| Viburnum Species  | Steeple Bush            | Red Mulberry      |
| Burning Bush      |                         |                   |

\*(Listed in Appendix A of TRM #21)

Note: A minimum of four species of trees and shrubs must be planted in the proposed wooded areas. (See Attachment 21.12.D. for tentative locations of woody areas). At least one hard mast producer (at a minimum rate of 90 seedlings/acre), one conifer (at a minimum rate of 30 seedlings/acre), and two shrub or soft mast producers (at a minimum rate of 30 seedlings/ acre each), will be in the selection of the four species. The total number of seedlings will be planted at a spacing necessary to obtain a stocking rate of 300 trees and shrubs per acre. Since this mine site is relatively small compared to the surrounding forest, a random planting pattern of the four woody species would be adequate for the intended purpose of enhancing the wildlife habitat. In general the woody species will be planted in those areas where survival is most likely to succeed, such as along the edge of the native forest along drainageways, and in areas where the herbaceous ground cover is thin.

TABLE 4a

## Benefits to Wildlife of the Recommended Herbaceous Plant Species

| <u>PLANT</u>                                         | <u>USES(a)</u> |
|------------------------------------------------------|----------------|
| <b>GRASSES</b>                                       |                |
| Bluestems - <i>Andropogon spp.</i>                   | CHS            |
| Deertongue - <i>Panicum clandestinum</i>             | HSC            |
| Red fescue - <i>Festuca rubra</i>                    | HSC            |
| Indiangrass - <i>Sorghastrum nutans</i>              | CHS            |
| <del>Japanese millet - <i>Echinochloa spp.</i></del> | S              |
| Millet (Foxtail) - <i>Setaria italica</i>            | S              |
| Oats - <i>Avena sativa</i>                           | SH             |
| Orchardgrass - <i>Dactylis glomerata</i>             | HSC            |
| Redtop - <i>Agrostis alba</i>                        | CHS            |
| Rye - <i>Secale cereale</i>                          | SH             |
| Ryegrass - <i>Lolium spp.</i>                        | HS             |
| Sorghum - <i>Sorghum spp.</i>                        | S              |
| Timothy - <i>Phleum pratense</i>                     | SH             |
| Wheat - <i>Triticum aestivum</i>                     | SH             |
| <b>LEGUMINOUS FORBS</b>                              |                |
| Alfalfa - <i>Medicago spp</i>                        | HSC            |
| Appalow lespedeza - <i>Lepedeza spp.</i>             | CSH            |
| Birdsfoot trefoil - <i>Lotus corniculatus</i>        | HC             |
| Clovers - <i>Trifolium spp.</i>                      | HS             |
| Cowpea - <i>Vigna sinebsis</i>                       | SH             |
| Common (Kobe) lespedeza - <i>Lepedeza striata</i>    | SH             |
| <del>Korean lespedeza - <i>L. stipulacea</i></del>   | SH             |
| Soybean - <i>Glycine max</i>                         | SH             |

(a) See bottom of next page (Table 4b) for definitions of uses.

TABLE 4b

## Benefits to Wildlife of the Recommended Woody Plant Species

| <u>PLANT</u>                                        | <u>USES(a)</u> |
|-----------------------------------------------------|----------------|
| <b>HARD MAST PRODUCERS</b>                          |                |
| Black Walnut - <i>Juglans nigra</i>                 | MBC            |
| Hickory's - <i>Carya spp.</i>                       | MBC            |
| Native Pecan - <i>Carya illinoensis</i>             | MBC            |
| Oak's - <i>Quercus spp.</i>                         | MBC            |
| <b>CONIFERS</b>                                     |                |
| East red cedar - <i>Juniperus virginiana</i>        | CSB            |
| Pines - <i>Pinus spp.</i>                           |                |
| <b>SHRUBS AND SOFT MAST PRODUCERS</b>               |                |
| American elder - <i>Sambucus canadensis</i>         | CBS            |
| Autumn olive - <del><i>Eleagnus umbellata</i></del> | FBC            |
| Bicolor lespedeza - <i>Lespedeza Bicolor</i>        | SHC            |
| Common Chokecherry - <i>Prunus virginiana</i>       | FBC            |
| Crabapple species - <i>Malus spp.</i>               | FCB            |
| Gray Dogwood - <i>Cornus foemina</i>                | FBC            |
| Green ash - <i>Fraxinus pennsylvanica</i>           | SB             |
| Hawthorn species - <i>Crataegus spp.</i>            | CFB            |
| Redbud - <i>Cercis canadensis</i>                   | CB             |
| Sassafras - <i>Sassafras albidum</i>                | BSC            |
| Serviceberry - <i>Amelanchier laevis</i>            | FCB            |
| Shining sumac - <i>Rhus copallina</i>               | FBC            |
| Silky Dogwood - <i>Cornus amomum</i>                | FBC            |
| Sugar maple - <i>Acer saccharum</i>                 | SB             |
| White Ash - <i>Fraxinus americana</i>               | SB             |
| Wild black cherry - <i>Prunus serotina</i>          | FBC            |
| Wild plum - <i>Prunus americana</i>                 | FBC            |

(a) Note: Classification system from "Revegetation of Kentucky Surface Mined Lands", 1983. (M) = Mast (Nuts and acorns); (S) = Seeds (as well as dry fruits, grains and achenes); (B) = Browse (bark, buds catkins, whole pods, whole heads of fruits, twigs, and small branches); (C) = Cover; (H) = Herbage or Foliage; and (F) = Fruit. The uses of each plant are arranged in descending order of their overall importance to the targeted wildlife species.

**Appendix G**  
**BMP'S**



**NALLY & HAMILTON ENTERPRISES, INC.**  
**RECOMMENDED BEST MANAGEMENT PRACTICES**  
**FOR PERMITTED AND STORM WATER DISCHARGES**

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**RECOMMENDED BEST MANAGEMENT PRACTICES**  
**FOR PERMITTED and STORM WATER DISCHARGES**

**1.0 INTRODUCTION**

Best Management Practices (BMPs) are instrumental in the management of Storm Water Pollution required by the National Pollutant Discharge Elimination System (NPDES) General Water Discharge Permits.

BMPs are measures or controls that reduce pollutants at the source to prevent the pollution of storm water runoff and other discharges from the site. These practices can be used to divert runoff away from areas of exposure to pollutants, such as raw materials or potential pollutant sources. In addition, BMPs can be used to direct polluted runoff to natural or other types of treatment.

## **2.0 WASTE WATER AND STORM WATER BEST MANAGEMENT PRACTICES BY ACTIVITY**

The Best Management Practices (BMP's) included in this guidance document are related to source reduction and treatment methods for specific processes and activities ongoing at the mine site. The permittee should consider the recommended practices in developing and/or revising their mining methods on these sites. In addition, the preventive measures mentioned may assist the mine(s) in achieving wastewater discharge benchmarks and limitations through pollution prevention.

All of the BMP's recommended in this guidance are intended to complement, not conflict with, existing state and federal regulations regarding the handling, containment, or treatment of any material or waste.

*The following BMP's relate to specific activities that are common for industrial facilities:*

Outside Storage of coal, mine refuse, and mine spoil.

Outside Container Storage and Waste Disposal

Loading and Unloading Liquid Materials

Emergency Spill Response and Cleanup Plan

Above-Ground Tank Storage

Fueling Stations

Vehicle and Equipment Washing

Vehicle and Equipment Maintenance

Sandblasting and Painting Operations

Inspection and Monitoring Activities

Dust Control

Erosion Control

Treatment Alternatives



## **2.1 Outside Storage of Coal, Mine Refuse, and Mine Spoil**

This BMP applies to facilities that stockpile coal, mine refuse, or mine spoil on site.

The permittee should select from among the following practices that would be appropriate for the type of material stored outdoors and exposed to storm water runoff:

1. Locate stockpiles out of the drains in the drainage pattern.
2. For new permanent stockpile areas on the site of facilities; paving or compacting the area where the material will be stored can significantly reduce the amount of sediment that can be transported by storm water runoff.

If paving or compacting of new stockpile areas are used the paved or compacted area should be sloped to minimize the pooling of water on the site, particularly with materials that could leach pollutants into storm water. Curbing or berming is recommended along the perimeter of the area to prevent contaminated runoff from leaving the site. The berms or curbs should be designed to direct the drainage to the permitted sediment control structures.

3. Spoil areas and mine refuse storage areas should be seeded as soon as possible with vegetative cover to reduce sediment transportation during rain events as well as any seepage from within stockpiled materials.

4. Maintain an Emergency Spill Response and Cleanup Plan.

## **2.2 Outside Container Storage and Waste Disposal**

This BMP refers to containers located outdoors and used to temporarily store materials, such as paints, oils, solvents, and waste materials (e.g., used batteries.)

If the mine site has container storage of materials in an outdoor location, the following practices are recommended to prevent contact between the container and storm water runoff:

1. Designate the location of the container area on the site and install a secondary containment or even a paved or lined floor with bermed or curbed sides within this area to contain and keep spills of materials and contaminated storm water runoff from leaving the bermed area.

The berm or curb should be of adequate height to contain an amount equal to the volume of the largest single storage tank, plus additional volume to account for potential rainfall accumulation. A good approximation of the needed volume would be 125% of the largest storage tank, but additional volume may be needed depending on the quantity of rainfall reaching the site. If a paved or lined floor is used slope the paving or lining on the floor of the designated area to a lined sump that will prevent the transfer of spilled liquids and/or contaminated runoff to surface water or groundwater.

2. If at all possible, cover the designated area for container storage or bring the containers indoors to prevent contact with rainfall.

If the entire area cannot be covered, it is important to cover containment bins, tanks, or hoppers to prevent rainfall from entering the container and percolating through the stored materials. Waste liquids

such as oils or coolants should be covered with tarpaulins or roofed structures if they are not in correctly sized secondary containments. The covers should be large enough to keep rainfall out of the containment berm surrounding the stored liquids.

3. Segregate and securely store incompatible or reactive materials in separate containment areas in order to prevent the mixing of materials should spills occur.

4. For containers that are mounted for direct removal of a liquid material by employees, install a bermed or covered area as described above in Practices 1 and 2. Allow 125% of the container size, or some higher approximation, for the containment volume. A drip pan should be placed under the mounted container for use during transfers of the liquid if they are not in a secondary containment.

5. Install guards around permanent tanks and piping to prevent damage from mobile equipment or vehicles.

6. Secure the designated storage area to prevent unauthorized persons from accessing storage containers and causing spills. Also provide warning signs, such as: AUTHORIZED PERSONNEL ONLY, DANGER - HAZARDOUS MATERIALS, FLAMMABLE MATERIALS, etc.

7. Inspect all containers at least monthly for deterioration to make sure leakage of the substance is not occurring. This is crucial to prevent contamination of storm water runoff that will come in contact with containers that are not covered. Also inspect the lids of drums or containers to ensure that they are in place and properly secured. A drum that contains materials with a specific gravity less than water may fill with rainfall from the bottom of the drum and allow the stored material to leak or spill out the top. It may also be helpful to obtain a storm sewer map from the local public works department to identify potential surface water discharge points on and around the site and their location in relation to containers or the storage area if spills should occur.

If the material stored is a hazardous waste, the permittee shall comply with any additional DEQ or federal regulations and requirements not mentioned in this guidance.

8. Maintain an Emergency Spill Response and Cleanup Plan (see Section 2.4).

### **2.3 Loading And Unloading Materials**

This BMP applies for both the loading and/or unloading of materials stored in containers and direct liquid or gas transfers from tanks. The loading or unloading of materials should take place at a location within the mine site so that, should a spill, occur it will not by-pass the wastewater treatment system.

If the transfer of materials occurs outdoors, the facility should consider the following practices to prevent the contamination of storm water runoff from spilled materials:

1. With truck transfer of materials, use loading docks with overhangs or door skirts to enclose the end of the trailer. The loading/unloading area should be designed to prevent storm water runoff from entering the transfer area with curbing or berming. The permittee should have the appropriate materials available for rapid cleanup of spills.

2. For tanker truck transfer to above-ground storage tanks, slope the floor of the transfer area to a sump or secondary containment system to prevent spillage entering the waterways.

3. Place drip pans as needed when making and breaking connections for the transfer, and under hose connections, hose reels, and filler nozzles when the transfer connections cannot be made within the confines of secondary containment.

4. Examine loading/unloading areas for dust or fumes or stains to determine if materials are being lost during these operations. Check vehicles and equipment frequently for leaks and repair them promptly. Clean up any leaks to the ground appropriately.

5. Maintain an Emergency Spill Response and Cleanup Plan.

#### **2.4 Emergency Spill Response And Cleanup Plans**

Every facility should maintain an appropriate Emergency Spill Response and Cleanup Plan for all material handling activities on the site. Areas where spilled materials can impact water runoff and associated drainage points should be clearly identified. Methods to prevent spills along with cleanup and notification procedures are identified in the "Spill Prevention Control and Countermeasures Plan and made available to appropriate personnel. The required cleanup equipment must be on site or readily available. A management person trained in spill containment and cleanup should be in charge of the work site during loading and unloading of materials.

The EPA requirements may be found in 40 CFR Part 112. In response to the Oil Pollution Act of 1990, EPA recently proposed amendments to 40 CFR Part 112 which may be found in Federal Register Volume 58, No. 30, February 17, 1993. The U.S. Coast Guard's interim rules may be found in Federal Register Volume 58, No. 23, February 5, 1993. Although the requirements from each agency are somewhat similar there are differences in planning volumes for worst case spills, initial response times, and recovery standards.

The following guidelines are recommended in preparing a Spill Prevention Control and Countermeasure Plan and are also useful when preparing the section of the storm water pollution control plan that addresses spills:

1. Describe the facility, provide the owner's name and address, describe the nature of the activities at the facility, and indicate the general types of chemicals used on the site.
2. Provide a site plan showing the location of chemical storage areas, the location of storm drains, the direction of the slope of the site toward the drains, and the location and description of any structures or devices on the site, such as control valves or lined sumps, to prevent spills from leaving the site.
3. Provide notification procedures that will be used in the event of a spill for contacting key personnel and local and state government agencies.
4. Provide detailed instructions regarding cleanup procedures, including how to handle fires and explosions should they occur.
5. List the designated person or position with overall spill response cleanup responsibility.
6. Describe the training program that will be implemented for key personnel. All employees at the facility should have basic knowledge of spill control procedures.

7. Provide a summary of the spill cleanup plan that will be posted at appropriate points throughout the work place. The summary should identify the spill cleanup coordinators, the location of cleanup kits, and phone numbers of regulatory agencies to be contacted in the event of a spill.

8. If a spill occurs, cleanup should begin immediately. No emulsifier or dispersant shall be used. If the spill could reach sanitary or storm sewers or surface waters, local and state government officials should be notified immediately.

## **2.5 Above-Ground Tank Storage**

These best management practices are recommended for tank storage systems on site. The following practices should complement any special requirements for these systems, such as any additional restrictions imposed by the Fire Marshall's Office.

1. Install an overfill protection on the storage tank to minimize the risk of spilling liquids during transfer and loading. Install guards around the tanks and piping to prevent damage from mobile equipment or vehicles.

2. For permanently installed tank storage systems, use curbing or diking to contain spills and leaks. The curbing should be of adequate height to contain a volume equal to the volume of the largest single storage tank plus rainfall, if the storage area is uncovered. A good approximation of the needed volume would be 125% of the largest storage tank, but additional volume may be needed depending on the quantity of rainfall reaching the site.

The floor area enclosed by the curbing needs to be covered with an impervious surface and sealed to prevent spills from contaminating groundwater. The paved or lined floor should also be sloped to a lined sump for collection of small spills. Weekly inspection, and if necessary, cleaning of the sump is needed to minimize the contamination of storm water.

3. If no contaminants are present, collect and remove or discharge accumulated rainfall from the curbed area frequently during the wet season.

4. Train employees in operating and spill response procedures. Label tanks and piping to reduce human error.

5. Maintain an Emergency Spill Response and Cleanup Plan.

## **2.6 Maintenance Activities Associated with Fixed Sites (i.e. Major Plant Construction or Major Maintenance)**

Coal processing facility construction sites and major maintenance and renovation activities may have many manufacturing activities in outdoor areas and produce pollutants that will contaminate storm water runoff. Particularly serious activities that occur outdoors and produce contaminants include rock grinding or crushing, parts grinding or sanding, painting or coating, degreasing or parts cleaning, or operations using hazardous materials.

The following practices are recommended to prevent contamination of storm water from such activities:

1. Alter or change the activity so that pollutants are not discharged.

2. Enclose the activity, if practical and cost-effective or bring it indoors. If the manufacturing activity is enclosed within a structure, floor drains can be installed to transport wastewaters to the wastewater treatment system. Contact with storm water would be prevented.

3. Cover the activity. If enclosing the manufacturing activity within a structure is too costly, construct a cover over the site (without walls). Berms or dikes may be constructed around the floor of the activity to retain rainfall that is carried into this area by wind. If contained on the floor, the contaminated storm water could then be discharged to the site's waste water treatment system for treatment.

In addition, waste piles can be covered temporarily with reinforced tarpaulins, polyethylene, polyurethane, Hypalon or polypropylene to prevent contamination of runoff.

4. Segregate the activity. If parts of the manufacturing process are the worst source of pollutants, these parts can be covered or enclosed to prevent contact with storm water. Floor drains can be installed, if allowed by the local public works department, to transfer wastewaters to the sanitary sewer system.

5. Establish a waste reduction program at the facility to eliminate or reduce the quantity of waste generated. Consider the following in establishing such a program: production planning and sequencing, process or equipment modifications, raw material substitutions or elimination, housekeeping measures and loss prevention, waste segregation and separation, closed-loop recycling, and employee training and education in waste reduction.

6. Maintain an Emergency Spill Response and Cleanup Plan.

## **2.7 Fueling Stations**

Fuels contain organic compounds and metals that adversely affect aquatic life. The following BMPs are recommended to prevent contamination of storm water runoff that will ultimately reach surface water bodies.

1. Install diking or grade the area around the fueling area to prevent storm water from flowing onto the area and becoming contaminated as much as possible.

2. Ensure all above ground fuel, oil, lubricant, and coolant storage tanks are in correctly sized (125% of largest container) secondary containments.

Ensure secondary containment design permits refilling connections to be made within the confines of the secondary containment and overflow drains drain into the containment structure.

3. Spilled fuels, oils and grease will leave the site can contaminate surface waters if not properly cleaned and disposed of. Remove spills using dry methods like spot cleaning with adsorbents or mechanically picking up the contaminated soil with a shovel or equipment. Place contaminated soil in the oily soil storage area designated for this purpose.

4. Retain suitable cleanup materials on the site for prompt cleaning of all spills. Absorbent materials like spill pads, spill booms, or kitty litter will be effective in containing certain spills. Do not wash any spillage into drainways. Dispose of the absorbent materials appropriately.

5. Personnel responsible for fueling vehicles should avoid overtopping fuel tanks.

6. Maintain an Emergency Spill Response and Cleanup Plan

## **2.5 Vehicle and Equipment Washing**

Wash water from vehicle and equipment cleaning operations may contain a variety of contaminants, which can be harmful to aquatic life and the quality of surface water bodies. These contaminants may include detergents, degreasing chemicals, oils, suspended solids, heavy metals, and organics that can cause serious pollution problems.

Options for disposal of wash water include:

1. Installing a washing system that recycles all wastewater. Recycling systems remove oil and solids from the wastewater so that the water may be reused

2. Discharging wastewater to sanitary sewer.

3. Washing your vehicles at a commercial vehicle washing operation with an approved disposal system.

4. If none of the above options are feasible, you may be able to discharge to the storm drainage system or to the ground. This option is dependent on the requirements of the state and/or local government. Permits are available in some states to cover vehicle washing.

## **2.9 Vehicle and Equipment Maintenance**

In areas used to maintain vehicles and equipment, storm water can easily become contaminated with solvents, oil, grease, waste automotive fluids, acids, and caustic wastes. These substances are harmful to aquatic life, and measures should be implemented to prevent storm water contamination.

The following practices are recommended:

1. Clean vehicle and equipment parts without using solvents. This will save on disposal costs since many solvents must be disposed of as hazardous wastes. Parts can be scraped with a wire brush or placed in a bake oven for cleaning. If solvents are used, designate a centralized cleaning station to keep solvents and residues in one location. Use drip pans, drain boards, and drying racks to direct drips and spills into a fluid holding tank for reuse.

2. Use nontoxic or less toxic solvents and cleaners. Examples include using non-caustic detergents for parts cleaning and using detergent-based or water-based cleaning systems instead of organic solvent degreasers.



Replace chlorinated organic solvents, such as 1,1,1-trichloroethane or methylene chloride, with non-chlorinated solvents such as kerosene or mineral spirits. If the list of active ingredients on the solvent container includes the term "chlor," then the solvent is chlorinated.

Use cleaners that can be recycled if possible. The supplier of the cleaners and solvents along with trade journals for the industry can provide information regarding waste minimization for these activities. Warehouse personnel are familiar with solvents permitted to be used – **BE SURE ONLY TO USE MATERIALS ACQUIRED THROUGH YOUR PURCHASING DEPARTMENT!**

3. Do not use running water from a hose to clean the work areas because the contaminated water could enter the storm drainage system and ultimately surface water bodies. Rags or spill pads can be used for cleaning small spills and a damp mop can be used for general cleaning. Absorbent materials including kitty litter, sawdust, spill pads and spill booms may be used for containing large spills. Dispose of clean up materials appropriately.

4. Place a drip pan or absorbent pads underneath vehicles and equipment when performing maintenance such as removing parts, unscrewing filters, or unclipping hoses. Promptly transfer the used fluids to the proper waste or recycling drums. Open containers, including full drip pans, should not be left lying around on the site. Any containers used to store materials other than their original containers must be clearly marked and identified as to contents.

5. Do not pour used or leftover cleaning solutions, solvents, and automotive fluids into drain inlets or ditches, floor drains, sinks, or into the sanitary sewer. These substances are toxic. Floor drains, even those under cover, are frequently connected to the storm drainage system.

Contact the distributor of leftover materials to see if unused portions can be returned.

6. Place used oil filters in funnels over the waste oil recycling or disposal collection tank to drain excess oil. ~~Crush and recycle~~ used oil filters if possible. Mark containers for used oil with the words "USED OIL."

7. When vehicles are driven to the site for repair, examine them for discharge of leaks. Place drip pans under the vehicles to collect fluids for recycling or proper disposal.

(Note: Air conditioning systems must be emptied, serviced, and maintained by certified technicians. For more information about freon recovery regulations, please contact the EPA at 1-800-296-1996.)

8. Store all cracked lead-acid and other liquid containing batteries in a non-leaking secondary container to retain acid leaks.

9. Recycle used materials such as degreasers, used oil, oil filters, antifreeze, cleaning solutions, automotive batteries, used rags, and hydraulic fluid. Separate wastes to reduce treatment costs and make recycling efforts easier. For example, keep chlorinated solvents separate from non-chlorinated solvents and do not mix used oil and solvents.

10. Maintain an Emergency Spill Response and Control and Countermeasure Plan.

## 2.10 Sandblasting and Painting Operations

Sandblasting and painting operations use materials and produce wastes that are potentially harmful to both human health and the environment. Overspray of paints, blasting without adequate containment, and uncovered grit piles may contribute to serious water pollution from toxic metals and highly toxic materials from antifouling paints. This pollution can lead to irreversible and lethal effects for many aquatic organisms. Dumping of paints, solvents, adhesives, oils, detergents, grit material, etc., not only damages the environment, but it is illegal and a violation of the federal Clean Water Act and State regulations. If materials classified as hazardous wastes are discharged, the dumping also violates hazardous waste regulations.

Generators of blast waste are required to characterize, handle and dispose of such waste according to state and federal regulations. This means that generators are responsible for determining if their waste is hazardous.

Of particular concern is paint, grit or wastewater containing antifouling ingredients, such as tributyl tin (TBT) or cuprous oxide, which require special handling because of their impact to the environment. Recent studies indicate that even the abrasive material, before blasting, can be harmful to marine life. The following guidelines are general recommendations for blasting and painting operations. However, specific guidelines to be followed for management of paint or grit waste, with or without antifouling ingredients, are below:

1. Prevent paint chips, abrasive blast material (before blasting), and grit waste from coming in contact with storm water runoff and surface water bodies. Outdoor blasting and painting should be done in designated areas that provide adequate protection to prevent overspray and fugitive emissions to insure compliance with the state and federal air quality regulations.
2. Operate all designated sites for blasting and painting operations with containment doors and ventilation filtration equipment in good working order.
3. Give special attention to existing wind and weather conditions in order to further minimize the impact of airborne emissions. Do not operate in windy conditions.
4. Provide a thorough cleaning of spent paint, paint chips, protective coatings, grit waste, etc., to prevent the discharge of these wastes into state waters.
5. Segregate wastes whenever possible to reduce treatment, disposal, and management costs. It is particularly important to separate non-hazardous wastes from hazardous wastes because of different regulatory requirements, and different treatment and disposal costs. Dispose of wastes appropriately.
6. Recycle solvents and any other materials where recycling opportunities exist.



## **7.11 Inspection and Monitoring Activities**

Inspecting and monitoring the equipment used in the mining operations can be important in preventing problems that can lead to leaks or spills of potential contaminants for storm water runoff. These activities are also needed for proper maintenance of storm water and waste water treatment facilities on the sites. Without adequate maintenance, sediment and other debris can quickly clog water treatment facilities and render them ineffective.

### **2.11.1 Maintenance Practices for Equipment and Process Areas**

A. Perform frequent inspections for structural integrity of items such as piping, valves, controls, joints, welds, tanks, drums, roofs and other sources of potential leaks and spills on the site that can contaminate runoff.

B. Ensure that personnel are present during material transfers both to prevent spills if possible and to clean up spills immediately. The personnel should be properly trained in spill containment methods including the use of absorbent materials.

### **2.11.2 Maintenance Practices for Water Treatment Facilities**

A. Inspect catch basins, drainage pipes, spillways, control valves and plugs, and related drainage structures at least monthly to determine if maintenance is needed. It may be useful to inspect outfalls during a significant rainfall or snowmelt event to determine how well the system is working.

B. Immediately repair any deterioration threatening the structural integrity of the facilities. Such repairs may include: removing rock and debris from spillways, clearing clogged pipes or drainage inlets, or removing excessive growth from drainage ditches for proper operation.

## **12.12 Dust Control**

Dust controls may be needed on mining sites for various reasons. If effective, dust controls can prevent pollutants from contaminating storm water runoff by reducing the surface and air transport of dust caused by these activities.

A. Use temporary controls such as palliatives, or chemical soil treatments that are applied as spray-on adhesives.

Common palliatives include calcium chloride, anionic asphalt emulsion, latex emulsion, and resin-water emulsions. Since certain chemicals may be inappropriate for some soil types or application areas, the permittee should check with the local government prior to application of the chemical treatments.

In addition, irrigation is a temporary measure involving a light application of water to moisten the soil surface. The correct amount of water should be applied because an excess of water can cause erosion.

B. Minimize soil exposure by temporary or permanent soil stabilization controls, such as mulching, seeding, applying topsoil, or planting trees. If existing vegetation on the site can be maintained, this will help in controlling dust.

C. Install temporary or permanent windbreaks or barriers that reduce airborne particles by slowing wind velocities and causing the particles to drop. Large trees and shrubs left in place can provide wind barriers, while temporary measures include solid board fences, tarp curtains, sediment walls, crate walls, and bales of hay.

#### **2.12.1 Practices to Control Dust from Material Handling, Process and Transfer Areas**

A. Install dust collection systems, such as negative pressure systems (vacuum systems), or collector systems (bag and cyclone), or filter systems.

B. Use water spraying and collect the dust-contaminated waters for treatment.

C. Use street sweepers to collect dusts. The vacuum type is more efficient and is most effective on dry areas. Brush sweepers can also be used.

D. Train employees in the proper operation of the equipment according to the manufacturers' recommendations and inspect the equipment regularly.

#### **2.13 Erosion and Sediment Control**

Erosion is the process by which soil particles are loosened and displaced by the action of water or wind on the soil surface. The loosened particles are called sediment, and the deposition of this material in streams is called sedimentation. Sedimentation and turbidity associated with sediment-laden flows degrade water quality.

Over time, erosion control is more effective than sediment control in preventing water quality problems. Erosion control is less subject to failure due to high flows, requires less maintenance, and is also less costly. In some cases a combination of erosion control and sediment control may be required. The following best management practices can be used for areas on mining sites with exposed soil due to steep slopes, soil stockpiles, heavy equipment traffic, or construction projects. Regular inspection and prompt maintenance are critical to the success of all the practices in this section. The selection of an appropriate measure will depend on the degree of slope on the site, sensitivity of the area to the intended use, stream or wetland features in the area, and type of soil encountered.

#### **2.14 Erosion Control Practices**

The following are recommended erosion control practices:

A. The preservation of existing vegetation on the site. Preserving the existing vegetation is frequently the best preventative measure for erosion. Because native or existing vegetation is already established, it is usually a better cover species than introduced species. Limit the removal of vegetation to as limited an area as possible to enable mining operations to operate. Do not disturb areas far in advance of mining.

B. The implementation of vegetative and soil protection practices for soils that are already exposed as soon as possible after contemporaneous reclamation. These practices reduce erosion potential in several ways. They shield the soil from the direct impact of rainfall or runoff, increase soil porosity and water storage capacity of the soil, reduce the energy of the runoff, and physically hold the soil in place with

the root system of the vegetation. Vegetative erosion controls include:

) The establishment of vegetative cover, either as a permanent cover or as a temporary measure prior to permanently stabilizing the area. Vegetative buffers or complete coverage can provide a significant reduction of erosion potential. This can be accomplished by seeding, seeding and mulching, or seeding and matting. Maintenance may be required to successfully vegetate an area. This practice is not suited for areas, which carry heavy traffic.

C. The installation of structural controls to reduce the energy of the water flowing across soils, or to divert flows from exposed areas. Reducing the energy of runoff streams is beneficial in that slower flows do not act as strongly in eroding the soils, and they do not carry as much sediment from the site. These controls are not generally successful as stand alone measures, but may enhance the effectiveness of other erosion reduction measures. Structural erosion control measures include the following:

i) The use of level spreaders or interceptor dikes and swales for long, exposed slopes or at the tops of shorter slopes. The velocity of the runoff can be reduced, and flows diverted from exposed areas by utilizing this type of structural control. Proper installation must be in accordance with approved mining permit requirements.

ii) The use of pipe slope drains to remove excess water or divert runoff from slopes or saturated soil areas, reducing the potential for erosion. The inlets and outlets should be properly designed for adequate stabilization. The outlet area is particularly important, as the higher velocity water at the end of pipe can be an extremely erosive force. Outlet design and correct installation are the keys to the success of this type of control.

The installation of outlet protection at all pipe, ditch or channel discharge points to help prevent scouring in the receiving stream or discharge area. Proper installation of stone, riprap, aprons or detention basins will allow the energy of the discharge to dissipate without eroding the surrounding soils.

iv) The use of check dams to reduce scouring and formation of gullies in small channels. Dams can be built from stone, logs, etc., and can be temporary measures or permanent installations. Dams should be spaced so that the top of the downstream dam is at the same elevation as the toe of the upstream dam. It is important that the center section of the dam be lower than edges. If the edges of the dam are lower or at the same elevation as the center, the chance for washouts at the ends increases dramatically.

v) Stream bank stabilization to control erosion from the areas along streams where vegetative practices are not feasible. Riprap, gabions, reinforced concrete structures such as bulkheads or retaining walls, or other measures should be designed by a licensed professional engineer to insure adequacy and effectiveness.

vi) Paving or graveling of roadways and haulageways to help reduce soil disturbance.

## **2.15 Sediment Control Practices**

The following are recommended sediment control practices:

A. The use of vegetation to retard the velocity of sediment-laden flows. Using vegetated swales or vegetated buffer strips to intercept runoff helps reduce the energy of the stream, allowing sediment to settle out and be captured by the vegetation.

B. The installation of structural controls to trap sediment, to reduce stream energy, and allow for settling of turbid waters. Structural controls include measures designed to physically trap sediment or allow sediment to settle out of runoff. Specific measures include the following.

i) Filter fabric silt fences are effective short term controls for trapping sediment and filtering sediment-laden flows. However, they must be properly installed and maintained. Prompt maintenance and repair can extend the life span of fences until erosion control measures have been established.

ii) Detention basins, or settling basins can be used in conjunction with outlet protection, ditching, and other measures to provide a way to slow down the velocity of a stream and allow the sediments to settle out of turbid flows. An appropriately designed outlet that filters the basin effluent is a very effective way to enhance the performance of such controls.

iii) Check dams, mentioned in the erosion control section, can be used to reduce channel velocities and capture sediment as it settles out. These must be designed and built with care to insure that the structure will enhance the erosion and sediment control and not create additional problems.

iv) Constructing paved or rocked roads or entrances can reduce the amount of mud and sediment that is tracked onto areas where the material could be washed into the storm drainage system.

### 3.0 ADDITIONAL RESOURCES

#### 3.1 Document List

Code of Federal Regulations (CFR), Title 40-Protection of Environment, Parts 122, 123, 124, and Title 33, Parts 153, 154, and 155. \* Sections of rule available from

Erosion/Sedimentation Control Plan Technical Guidance Handbook, Clackamas County, OR, August 1994. \* Available from Clackamas County (503) 650-3737

Guidance Document for Preparation of the NPDES Storm Water Pollution Control Plan, Oregon Department of Environmental Quality, August 1997.

Nonpoint Source Pollution Control Guidebook for Local Government, Oregon Department of Environmental Quality & Oregon Department of Land Conservation and Development, June 1994.

- Stormwater Quality Facilities, A Design Guidance Manual, City of Portland, Bureau of Environmental Services (BES), March, 1995.
- Available from City of Portland (503) 823-5600.
- Stormwater Management Manual, City of Portland, Bureau of Environmental Services (BES), expected to be available in 1998. \* Available from City of Portland (503) 823-5600.
- Stormwater Program Guidance Manual for the Puget Sound Basin, Volumes 1 & 2, Publication #92-32 and #92-33, Washington Department of Ecology, WA, July 1992. \* Available for fee from WA DOE (206) 4387528.
- Stormwater Management Manual for the Puget Sound Basin (The Technical Manual), Publication #91-75, Washington Department of Ecology, WA, February 1992. \* Available for fee from WA DOE (206) 4387528.
- Storm Water Management for Industrial Activities, U.S. Environmental Protection Agency (EPA), April 1992. \* Available for fee from Education Resource Information Center/Clearinghouse (614) 292-6717, order #447N.
- Storm Water Management for Construction Activities, EPA, April 1992. \* Available for fee from Education Resource Information Center/Clearinghouse (614) 292-6717. order #482N.
- Water Quality Best Management Practices Manual for Commercial and Industrial Businesses. City of Seattle. WA. June 1989. \* Available for fee from WA DOE (206) 438-7528.